TM 8110
TM 8120

Oscilloscope Probes

INSTRUCTION MANUAL

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MARCONI INSTRUMENTS

INSTRUCTION MANUAL

EBM 8110/8120

for

×1 ×10 Attenuator Probe TM 8110

and

×1 Low Capacitance Probe TM 8120

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1965

MARCONI INSTRUMENTS LIMITED
ST. ALBANS HERTFORDSHIRE ENGLAND

L.P. 5c
12/67/C

EBM 8110/8120
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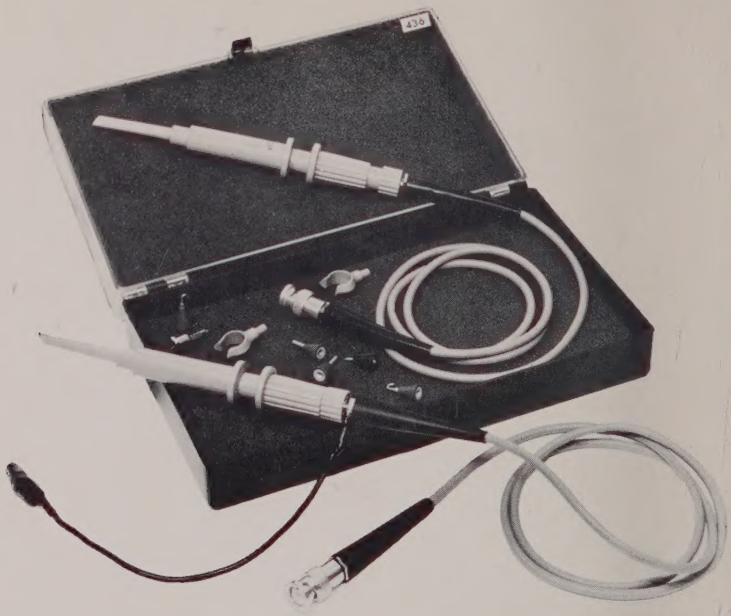

Fig. 1.1 TM 8110 and TM 8120 probes with a selection of accessories

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1 General information

1.1 INTRODUCTION

This manual describes two oscilloscope probes; the ×1 ×10 Attenuator Probe TM 8110 and the ×1 Low Capacitance Probe TM 8120.

TM 8110 is primarily a high-impedance 10:1 attenuation probe for accurate display of high frequency waveforms or short rise-time pulse signals. Provision is also made to switch the probe to a straight through position, by-passing the attenuator resistor.

With the switch in the ×10 position a 9 MΩ resistor forms a 10:1 potential divider with the oscilloscope input resistance. To preserve the pulse response, a capacitor comprising two concentric tubes is connected in parallel with the resistor; by adjustment of the relative position of the tubes the probe performance can be optimized for the oscilloscope in use. Twisting the nose of the probe allows switch contacts to short circuit the outer tube to the inner and so convert the probe into a 1:1 device.

The coaxial connecting cable has a resistive inner conductor to give critical damping of the reflections that occur because of the impedance mismatch at each end. The inner conductor is kinked and so the cable, although flexible, possesses the ability to withstand considerable rough handling without conductor breakage. The mechanical features of the probe are further enhanced by the silicone-rubber outer covering of the cable which is resistant to damage by contact with a hot soldering iron.

TM 8120, although similar in appearance, is a much simpler probe, having no attenuation nor capacitive compensation but with the same mechanical features as TM 8110.

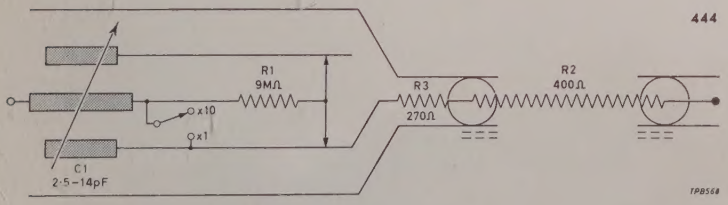

Fig. 1.2 TM 8110 Circuit diagram

1.2 DATA SUMMARY

	TM 8110	TM 8120
Attenuation ratio	Switchable ×1 or ×10	×1
Input conditions	When used with a 1 MΩ 30 pF oscilloscope: × 1 resistance 1 MΩ, capacitance less than 70 pF × 10 resistance 10 MΩ, capacitance less than 9pF.	Has series resistance of 400Ω with distributed capacitance of approx. 35 pF. The capacitance is approx. 47 pF when used with a 12 pF oscilloscope or 95 pF with a 60 pF oscilloscope.
Rise time	× 1 damped for zero overshoot with 30 pF oscilloscopes. Rise time typically less than 65 nsec when fed from a 50 Ω source into a 30 MHz oscilloscope. × 10 approximately 5 nsec.	Damped for zero overshoot with 30 pF oscilloscopes. Rise time typically less than 30 nsec when fed from a 50 Ω source into a 30 MHz oscilloscope.
Capacitive compensation	Adjustment to probe allows use with oscilloscopes of 12 to 60 pF input capacitance. (The best pulse response is obtained with 1 MΩ, 30 pF oscilloscopes.)	
Maximum input voltage	±600 V d.c. or 600 V peak-to-peak. ×1 derated at frequencies above 550 kc/s, see Fig. 2.5. ×10 derated at frequencies above 15 MHz see Fig. 2.5.	±600 V d.c. or 600 V peak-to-peak derated at frequencies above 1 MHz, see Fig. 2.6.

1.3 ACCESSORIES

Accessories supplied

A full set of accessories is supplied with each probe.

All the probe tips are fitted by screwing onto the 6BA thread exposed at the front of the probe.

Clip tip Enables the probe to be clipped onto a solder tag or wire etc. To open the clip squeeze the ring on the clip-tip body towards the similar ring on the probe body.

Other tips Four simple tips, of various shapes, are supplied. One will fit the centre conductor of a BNC or type N socket whilst another is similar to a banana plug and will fit a 4 mm socket.

Probe support clip To use, insert one end of the clip into an unused 4 mm socket on the oscilloscope front panel. A probe can then be conveniently parked by pressing it between the jaws of the clip.

Cable markers Three pairs of markers are supplied, coloured red, green and blue. These are intended to be clipped onto each end of a cable to assist identification when more than one probe is in use at a time.

Earth leads Three leads, 3, 6 and 12 inches long, are provided. One end of each clips onto the waist at the rear end of the probe. The other end is fitted with a crocodile clip.

Optional accessory

Earth Bayonet M.I. code 44416-904

Provides very low inductance earth connection between the probe barrel and the equipment under test.

To fit the bayonet slide it over the nose of the probe, making sure that the spring connecting finger lines up with the cut-out in the probe body which reveals the brass barrel. Push the bayonet along the probe until the spring finger is firmly located against the back edge of the cut-out.

To adjust the length of the bayonet connection, slacken the collet chuck, that holds the bayonet pin, by turning the knurled locking nut. Push the pin to the desired position and afterwards lock the chuck again.

The earth bayonet bracket may alternatively be used with the 3 inch earth lead by clipping this just behind the locking nut.

2 Operation

2.1 SELECTION AND USE

For most applications choose TM 8110, $\times 1$ $\times 10$ Attenuator Probe, which will apply lesser shunt loading and will give better frequency response and pulse wave shape than TM 8120. The shunting effect of TM 8110 is, however, not negligible at the highest frequencies and in order to estimate it refer to Fig. 2.1. With the capacitive compensation properly adjusted, the variation of effective input capacitance is from about 6.5 pF with a 12 pF oscilloscope to about 12 pF with a 60 pF oscilloscope.

Overall bandwidth of any probe is affected by external factors; in the case of TM 8110 switched to $\times$ 10 it is dependent on the oscilloscope

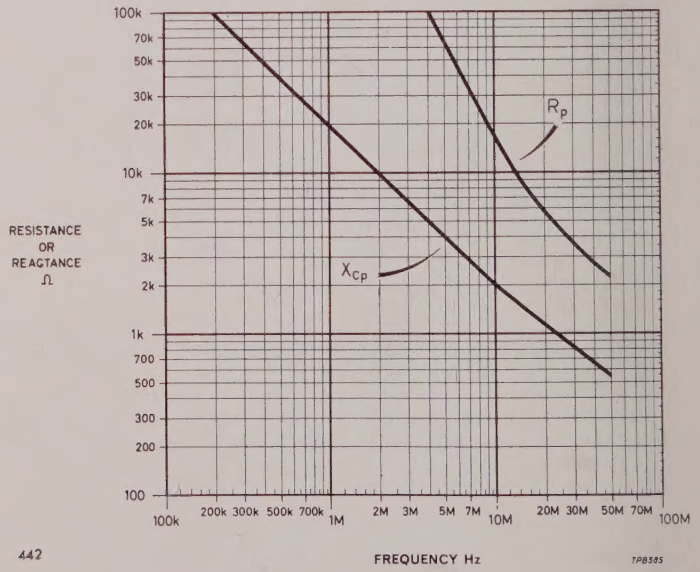

Fig. 2.1 TM 8110 switched to $\times 10$. Typical effective shunt resistance and capacitive reactance plotted against frequency. Probe connected to 1 MΩ, 30 pF oscilloscope

input capacitance. For a probe without attenuation, such as TM 8120 or TM 8110 switched to × 1, the factor having the greatest effect on bandwidth is the source impedance of the signal. These effects are shown in Figs. 2.2, 2.3 and 2.4 which indicate the responses of typical probes.

Where ×10 attenuation is not acceptable, *e.g.* for low level, low frequency measurements, TM 8120 ×1 Low Capacitance Probe can be used or, alternatively, TM 8110 can be switched to ×1. Another requirement for the higher sensitivity probe that often arises is the need to feed a trigger signal to the time base.

Three different length earth leads are supplied with each probe. Each lead is intended to fit by clipping onto the waist at the rear end of a probe. Use the shortest practicable earth lead when the best frequency response or pulse shape is wanted.

TM 8110, ×1 ×10 Attenuator Probe is switched from the ×10 to the ×1 position, or vice versa, by turning the switch knob forming the nose of the probe through 60°. This switching action is still available when the clip tip is fitted.

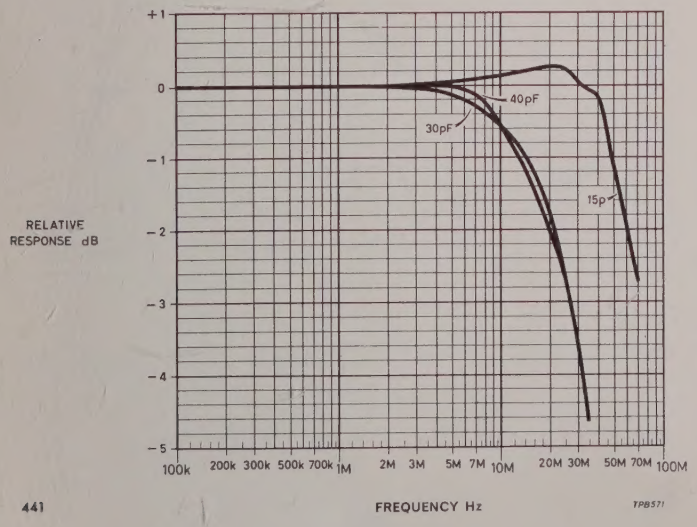

Fig. 2.2 TM 8110 switched to ×10, typical frequency response curves. Relative response plotted against frequency with oscilloscope input capacitance as parameter

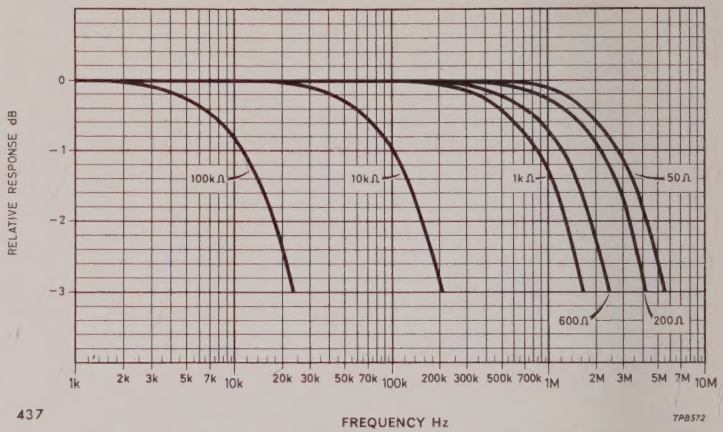

Fig. 2.3 TM 8110 switched to × 1, typical frequency response curves. Relative response plotted against frequency with source impedance as parameter; oscilloscope input capacitance 30 pF

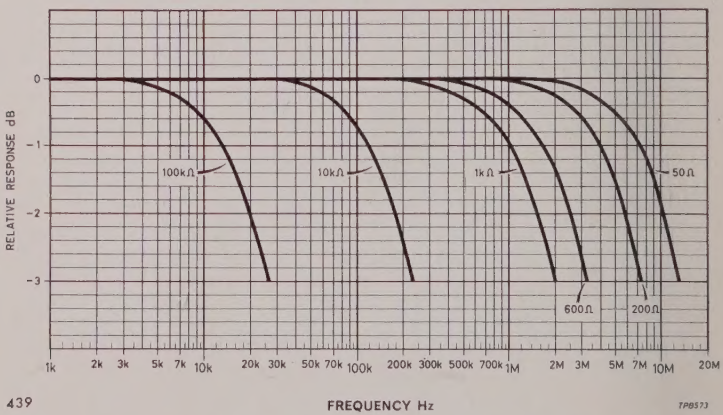

Fig. 2.4 TM 8120 typical frequency response curves. Relative response plotted against frequency with source impedance as parameter; oscilloscope input capacitance 30 pF

2.2 VOLTAGE DERATING

Because of the increasing capacitive current with frequency and the dielectric losses that occur at higher frequencies, it is necessary to restrict the peak-to-peak applied voltage. Details are given in graphical form in Fig. 2.5 for TM 8110 and in Fig. 2.6 for TM 8120.

Where the signal consists of pulses of r.f. the full derating need not be applied. The maximum voltage under pulse conditions is $V_p = \frac{V_f}{\sqrt{D}}$, where V_f is the voltage read from the derating curve at the frequency f and D is the pulse duty factor. The absolute maximum figure of 600 V peak-to-peak must, however, be observed.

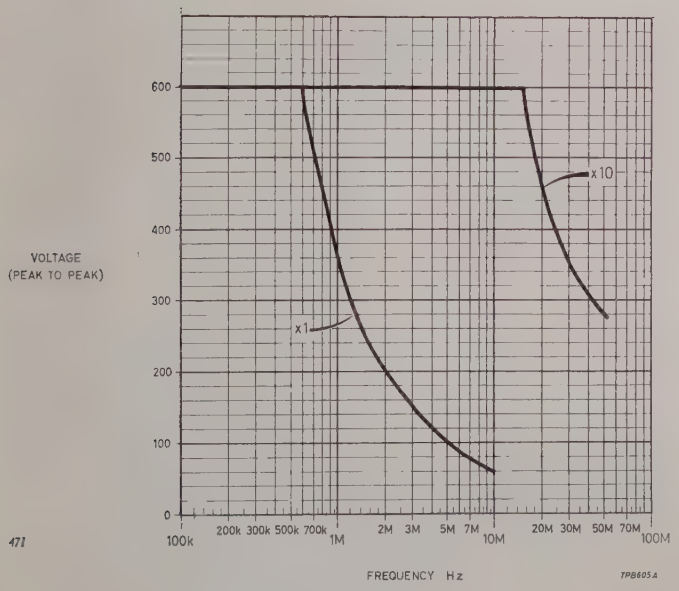

Fig. 2.5 TM 8110, voltage derating curves

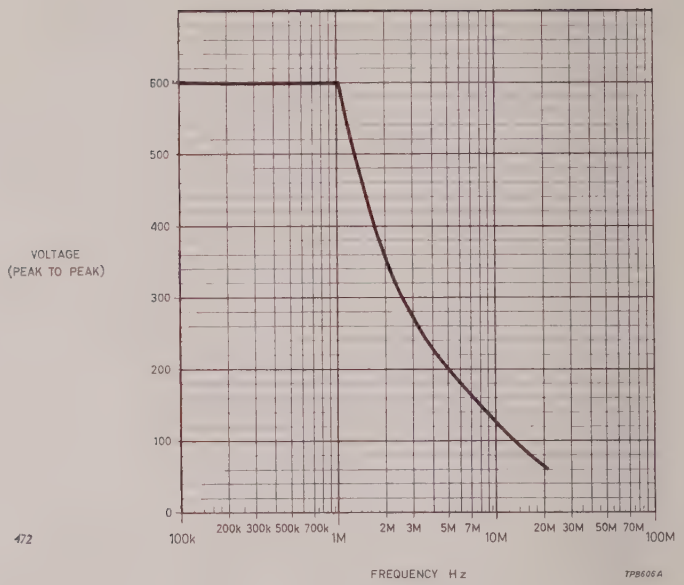

Fig. 2.6 TM 8120, voltage derating curve

2.3 CAPACITIVE COMPENSATION—TM 8110

Before using the probe check that the capacitive compensation is correct; this is particularly important if the probe is connected to another oscilloscope or if the plug-in unit is changed.

To carry out the compensation, slacken the locking sleeve, turn the switch knob to $\times 10$ and connect the probe tip to a source of a good square wave. Such a square wave should be flat-topped with a fast rise and a repetition rate in the region of 1 kHz to 5 kHz. When using a Marconi Instruments oscilloscope, such as TF 2200 series, a suitable signal can be conveniently obtained from the Bright-up terminal. View the waveform on the oscilloscope and rotate the trimmer adjuster with respect to the rear of the probe until the best square wave shape is displayed. Tighten the locking sleeve and make sure that the setting has not been disturbed.

There is no capacitive compensation when the probe is switched to the $\times 1$ position.

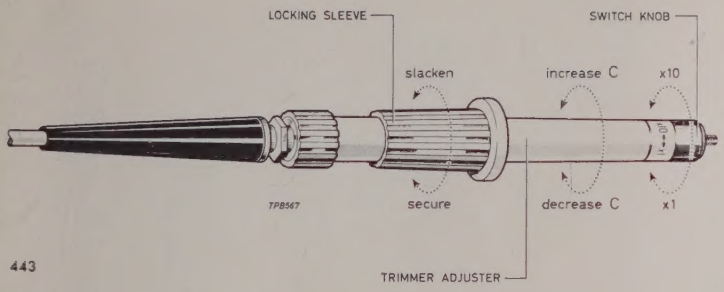

Fig. 2.7 TM 8110, ×1 ×10 Attenuator Probe

Capacitive compensation—trace derived from Bright-up waveform of TF 2200 series oscilloscope
Function switch to DELAY (B) + (A). B time base velocity 200 μsec/cm, A time base velocity 100 μsec/cm, Y sensitivity 50 mV/cm

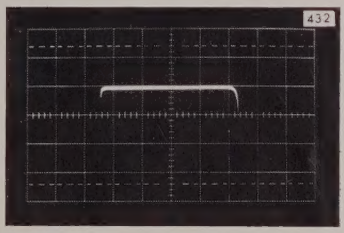

Fig. 2.9 Correct

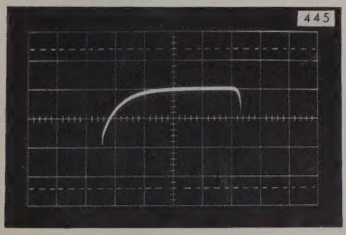

Fig. 2.8 Insufficient trimmer capacitance

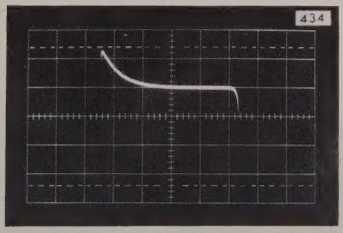

Fig. 2.10 Excessive trimmer capacitance

Capacitive compensation—trace derived from 1 KHz square wave generator. Oscilloscope sweep velocity 500 μsec/cm

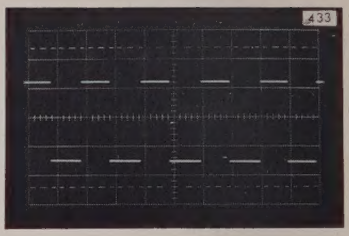

Fig. 2.12 Correct

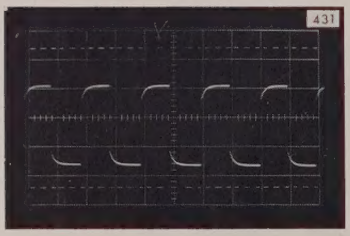

Fig. 2.11 Insufficient trimmer capacitance

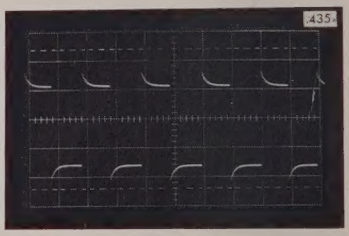

Fig. 2.13 Excessive trimmer capacitance

3 Replaceable parts

When ordering replacement parts, address the order to our Service Division (for address see rear cover) or nearest agent. Specify the following information for each part required. (1) Type number of instrument (2) Description of part (3) M.I. code number

TM 8110

Description	*M.I. code*
Barrel assembly (includes switch and 9 MΩ resistor)	TM8195
Cable assembly	44416–042
Locking sleeve, green (replacement for all versions)	37583–406
Clip tip	43145–026
Set of accessories (excluding clip tip)	44416–901

TM 8120

Probe, complete with cable	44416–041
Clip tip	43145–025
Set of accessories (excluding clip tip)	44416–901

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